American Condensed Peat: Experimental Tests to Determine its Value for Blast and Puddling Furnace Use, &c.

BY J. BLODGET BRITTON.

(*Read before the American Philosophical Society, April* 20, 1877.)

At the meeting of the fifth of January last I exhibited a small sample of condensed air-dried peat, prepared by the Dodge process, at works in operation near Syracuse, N. Y., under the direction of Jas. M. Hart and others, and stated that my purpose was to ascertain by analysis its general composition in order to find what value it possessed for blast and puddling furnace use and generating steam in boilers, and would communicate to the Society the results obtained. Since then I have received more of the same material charred, and some samples prepared by the Wright process, at works at Rome, N. Y., under the direction of the patentee, W. E. Wright; and also some samples of true brown coal or lignite, apparently a derivative of peat, found in considerable quantity in more or less disconnected deposits of from one to seven feet in thickness, principally in the region of the Ouachita River in Southern Arkansas. In order to embrace in the communication the results of the analyses of these last samples, there has been more delay than was anticipated. Portions of the samples are now presented for inspection and comparison, and also I respectfully submit the results of the analytical examinations so far made.

The lignite has a specific gravity of 1.29. It is lighter in color than the peats, and more uniform in structure, but by exposure to a drying atmosphere, however slowly the drying is effected, becomes quite friable, and at once breaks into pieces when roughly handled. It ignites most readily, and with a draft gives a long, bright flame and very little smoke, but would not answer the purposes of the blacksmith; it does not cake or form a coherent coke.

Results of analysis.

Water	23.62
Crude oleaginous matter	12.49
Other volatile matter more or less combustible	28.44
Ash	4.85
Fixed carbonaceous matter	30.60
Total	100.00

Included in the above:

Sulphur	.551
Sulphuric acid	.322
Phosphoric acid	.007

Composition of the Ash.

Ferric oxide	24.45
Silica	40.14
Alumina	26.61
Lime	6.31
Magnesia	.16
Sulphuric acid	.60
Phosphoric acid	.12
Alkali, undetected matter and loss	1.61
Total	100.00

The sample of peat marked "From Illinois" (about 1 lb.), came with the one from the Syracuse Works, and was prepared, it is supposed, by the Dodge process, specific gravity 1.32.

Results of Analysis.

Water	13.90
Volatile matter more or less combustible	48.70
Ash	15.26
Fixed carbonaceous matter	22.14
Total	100.00

Included in the above:

Sulphuric acid	.30
Phosphoric acid	practically none

Composition of the Ash.

Ferric oxide	9.50
Silica	43.00
Alumina	18.20
Lime	24.41
Magnesia	.18
Manganous oxide	.22
Sulphuric acid	1.90
Phosphoric acid	trace
Alkali, undetected matter and loss	2.59
Total	100.00

The sample of peat from the Syracuse Works (about 40 lbs.) was dug from an extensive bog nine miles north of the city, and prepared by grinding into pulp in a bath of water and then draining and air-drying. The cost of the material in quantity, cut and broken into pieces somewhat larger than a man's fist, and dried in condition like the sample exhibited, is stated to be not exceeding $1.25 per gross ton. It is not at all friable

but, on the contrary, is tough and strong, and will bear rougher handling than many of the bituminous coals. It ignites readily, and, like the lignite, burns with a long, bright flame and little smoke. The specific gravity of the pieces tested varied considerably from below 1 to 1.28; not more than one-half of them sunk in water.

Results of Analysis.

Water	21.68
Crude oleaginous and tarry matter	16.47
Other volatile matter more or less combustible	28.27
Ash	8.12
Fixed carbonaceous matter	25.46
Total	100.00

Included in the above:

Sulphuric acid	2.325
Phosphoric acid	.068

Composition of the Ash.

Ferric oxide	7.55
Silica	13.35
Alumina	6.54
Lime	44.31
Magnesia	1.26
Manganous oxide	trace
Sulphuric acid	21.60
Phosphoric acid	.74
Alkali, undetected matter and loss	4.65
Total	100.00

The sample of charred peat (about 8 lbs.) had an average specific gravity of 1.22. It was friable, and with ordinary handling broke into pieces of the size of a walnut and less. A portion of it was thoroughly dried, but afterward found to reabsorb moisture from the atmosphere readily; exposed to the air in a chamber of the laboratory, it regained 7.20 per cent. in 48 hours.

Results of Analysis.

Water	13.10
Volatile matter more or less combustible	22.69
Ash	15.27
Fixed carbonaceous matter	48.94
Total	100.00

These results show that the material had not been thoroughly coked, but merely charred. Tested in a good 12 inch wind assay furnace it

failed to produce heat sufficient for the reduction of an ore of iron to a button of metal; the quantity, though, was scarcely sufficient for a conclusive test. It burned with a roar, and gave flame enough to heat the pipe red-hot for some distance, which I never found anthracite to do in the same furnace.

The sample of peat from Rome, N. Y. (about 50 lbs.), was dug from a bog in Oneida county, where large bodies of it exist, and prepared by first grinding into pulp, then partially compressing and air-drying, and, lastly, more completely drying in a current of air artificially heated. The cost of preparing in quantity is estimated at under $1.50 per gross ton. The pieces, like those of Syracuse article, are of suitable size, tough and strong. The specific gravity varied mostly between 1 and 1.21; nearly all of the pieces tested sank in water.

Results of Analysis.

Water	14.39
Crude oleaginous and tarry matter	19.77
Other volatile matter more or less combustible	30.59
Ash	12.40
Fixed carbonaceous matter	22.85
Total	100.00

Included in the above:

Sulphuric acid	1.44
Phosphoric acid	.17

Composition of the Ash.

Ferric oxide	7.91
Silica	35.24
Alumina	14.83
Lime	25.21
Magnesia	.36
Manganous oxide	1.05
Sulphuric acid	11.32
Phosphoric acid	1.35
Alkali, undetected matter and loss	2.73
Total	100.00

A portion of this sample was tested in the assay furnace with about the same effect as that produced by the charred peat. Another portion was tested for liability to absorb moisture from the atmosphere, and found to regain 7.70 per cent. at a temperature between 65° and 73° F. in three days. What it would regain out of doors in a covered, latticed bin can be inferred.

From the facts stated it is clear that neither of the samples examined would be equal to wood charcoal for use in blast furnaces as they are now

constructed; if, unmixed with other fuel, they would answer for such use at all with profit. If they were coked and made into a compact coal, tough enough to withstand the pressure and abrasion of the ore and flux without unduly crushing—which, I believe, would be quite impracticable with the lignite—they might answer well; the large quantity of ash they contain would be the only objection. The ash, however, being rich in lime and also containing some potash and soda, would not prove very refractory. The sulphuric acid would not become reduced and give sulphur to the iron, but pass off mostly as sulphate in the slag, and the phosphorus present being small would have little effect. The peat from Illinois would afford 68.92 of ash with 100 parts of fixed carbon, that from Syracuse 31.50, and that from Rome 54.22. Wood charcoal usually affords less than 1 per cent. of ash; coke from bituminous coal, variable, but usually less than 12 per cent., and anthracite, also variable, but usually less than 8 per cent.

As a fuel for use in puddling furnaces these condensed peats would unquestionably answer, and best when well dried. They would burn freely without caking or forming any undue amount of clinker, require no excess of blast or draft, and afford combustible gas free from sulphur in greater volume than the ordinary bituminous coals. By mixing the gas with heated air at or near the bridge walls, an exceedingly high heat could be produced. For use in the Siemens regenerative furnace they would be especially well adapted, their contents of moisture being no disadvantage, but decidedly beneficial. Burning, as they could be made to, with a long, hot and almost smokeless flame, their value for the production of steam in stationary and other boilers would be great, and for the production of an illuminating gas of high candle power they would be no less valuable. I regard them as not at all liable to spontaneous combustion.

Much has been said of the value of peat for fuel purposes. The literature upon the subject is voluminous. My conclusions, however, are not drawn from anything hitherto published, but alone from the facts revealed by the analyses and tests made as stated. Peats differ more or less, and some very widely in the relative proportions of their constituents, and their fitness for use depends materially upon the manner in which they are prepared; hence, to determine the true value of any one, a chemical analysis and other tests should be resorted to.